Octal buffer/line driver; inverting; 3-state Rev. 2 — 26 November 2010

Product data sheet

1. General description

The 74AHC240 and 74AHCT240 are 8-bit inverting buffer/line drivers with 3-state outputs. These devices can be used as two 4-bit buffers or one 8-bit buffer. They feature two output enables ($1\overline{OE}$ and $2\overline{OE}$), each controlling four of the 3-state outputs. A HIGH on $n\overline{OE}$ causes the outputs to assume a high-impedance OFF-state. Inputs are over voltage tolerant. This feature allows the use of these devices as translators in mixed voltage environments.

2. Features and benefits

- Balanced propagation delays
- All inputs have a Schmitt-trigger action
- Inputs accepts voltages higher than V_{CC}
- For 74AHC240 only: operates with CMOS input levels
- For 74AHCT240 only: operates with TTL input levels
- ESD protection:
 - HBM JESD22-A114F exceeds 2000 V
 - CDM JESD22-C101D exceeds 1000 V
- Multiple package options
- Specified from -40 °C to +85 °C and from -40 °C to +125 °C

3. Ordering information

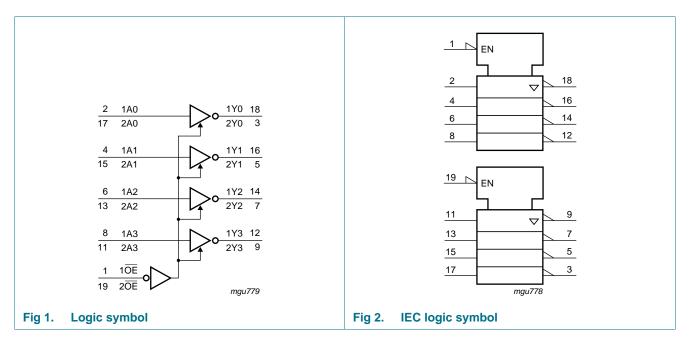
Table 1.Ordering information

Type number	Package								
	Temperature range	Name	Description	Version					
74AHC240D	–40 °C to +125 °C	SO20	plastic small outline package; 20 leads;	SOT163-1					
74AHCT240D			body width 7.5 mm						
74AHC240PW	-40 °C to +125 °C TSSOP20		plastic thin shrink small outline package; 20 leads;	SOT360-1					
74AHCT240PW			body width 4.4 mm						
74AHC240BQ	–40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced	SOT764-1					
74AHCT240BQ			very thin quad flat package; no leads; 20 terminals; body 2.5 \times 4.5 \times 0.85 mm						

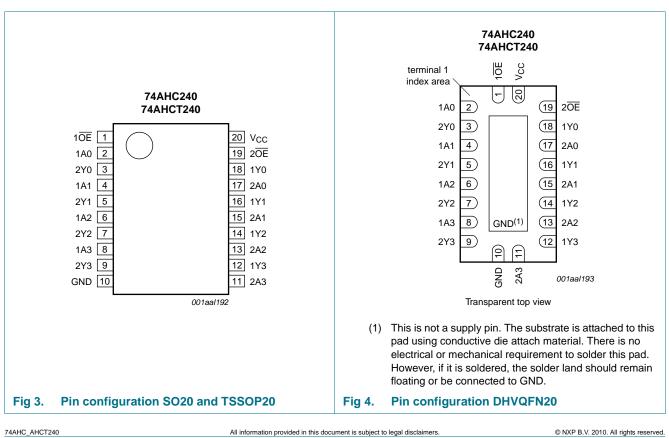


Octal buffer/line driver; inverting; 3-state

Functional diagram 4.



Pinning information 5.



5.1 Pinning

Octal buffer/line driver; inverting; 3-state

5.2 Pin description

Table 2. Pin des	cription	
Symbol	Pin	Description
1 <mark>OE</mark>	1	output enable input (active LOW)
2 0E	19	output enable input (active LOW)
1A0, 1A1, 1A2, 1A3	2, 4, 6, 8	data input
2A0, 2A1, 2A2, 2A3	17, 15, 13, 11	data input
1Y0, 1Y1, 1Y2, 1Y3	18, 16, 14, 12	data output
2Y0, 2Y1, 2Y2, 2Y3	3, 5, 7, 9	data output
GND	10	ground (0 V)
V _{CC}	20	power supply

6. Functional description

Table 3. Function table ^[1]		
Control	Input	Output
nOE	nAn	nYn
L	L	н
L	Н	L
Н	Х	Z

[1] H = HIGH voltage level; L = LOW voltage level; X = don't care; Z = high-impedance OFF-state.

7. Limiting values

Table 4.Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

				.0	,
Symbol	Parameter	Conditions	Min	Max	Unit
V _{CC}	supply voltage		-0.5	+7.0	V
VI	input voltage		-0.5	+7.0	V
I _{IK}	input clamping current	V _I < -0.5 V	<u>[1]</u> –20	-	mA
I _{OK}	output clamping current	$V_{\rm O}$ < –0.5 V or $V_{\rm O}$ > $V_{\rm CC}$ + 0.5 V	<u>[1]</u> _	±20	mA
lo	output current	V_{O} = -0.5 V to (V _{CC} + 0.5 V)	-	±25	mA
I _{CC}	supply current		-	75	mA
I _{GND}	ground current		-75	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	$T_{amb} = -40 \text{ °C to } +125 \text{ °C}$	[2] _	500	mW

[1] The minimum input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SO20 package: above 70 °C the value of P_{tot} derates linearly with 8.0 mW/K. For TSSOP20 package: above 60 °C the value of P_{tot} derates linearly with 5.5 mW/K. For DHVQFN20 package: above 60 °C the value of P_{tot} derates linearly with 4.5 mW/K.

Octal buffer/line driver; inverting; 3-state

8. Recommended operating conditions

Table 5.	Recommended	operating	conditions
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	1 0					
Symbol	Parameter	Conditions	Min	Тур	Мах	Unit
74AHC240	D					
V _{CC}	supply voltage		2.0	5.0	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 3.3 V \pm 0.3 V	-	-	100	ns/V
		V_{CC} = 5 V \pm 0.5 V	-	-	20	ns/V
74AHCT2	40					
V _{CC}	supply voltage		4.5	5.0	5.5	V
VI	input voltage		0	-	5.5	V
Vo	output voltage		0	-	V _{CC}	V
T _{amb}	ambient temperature		-40	+25	+125	°C
$\Delta t / \Delta V$	input transition rise and fall rate	V_{CC} = 5 V \pm 0.5 V	-	-	20	ns/V

9. Static characteristics

Table 6. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C		−40 °C t	to +85 °C	_40 °C t	o +125 °C	Unit
			Min	Тур	Мах	Min	Max	Min	Max	
74AHC2	40									
VIH	HIGH-level	V _{CC} = 2.0 V	1.5	-	-	1.5	-	1.5	-	V
	input voltage	V _{CC} = 3.0 V	2.1	-	-	2.1	-	2.1	-	V
		V _{CC} = 5.5 V	3.85	-	-	3.85	-	3.85	-	V
V _{IL}	LOW-level	V _{CC} = 2.0 V	-	-	0.5	-	0.5	-	0.5	V
	input voltage	V _{CC} = 3.0 V	-	-	0.9	-	0.9	-	0.9	V
		V _{CC} = 5.5 V	-	-	1.65	-	1.65	-	1.65	V
011	HIGH-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	$I_0 = -50 \ \mu\text{A}; \ V_{CC} = 2.0 \ \text{V}$	1.9	2.0	-	1.9	-	1.9	-	V
		$I_{O} = -50 \ \mu\text{A}; \ V_{CC} = 3.0 \ \text{V}$	2.9	3.0	-	2.9	-	2.9	-	V
		$I_{O} = -50 \ \mu\text{A}; \ V_{CC} = 4.5 \ \text{V}$	4.4	4.5	-	4.4	-	4.4	-	V
		$I_{O} = -4.0 \text{ mA}; V_{CC} = 3.0 \text{ V}$	2.58	-	-	2.48	-	2.40	-	V
		$I_{O} = -8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	3.94	-	-	3.80	-	3.70	-	V
V _{OL}	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}$								
	output voltage	$I_0 = 50 \ \mu A; \ V_{CC} = 2.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 50 \ \mu A; \ V_{CC} = 3.0 \ V$	-	0	0.1	-	0.1	-	0.1	V
		$I_0 = 50 \ \mu A; \ V_{CC} = 4.5 \ V$	-	0	0.1	-	0.1	-	0.1	V
		I_{O} = 4.0 mA; V_{CC} = 3.0 V	-	-	0.36	-	0.44	-	0.55	V
		$I_{O} = 8.0 \text{ mA}; V_{CC} = 4.5 \text{ V}$	-	-	0.36	-	0.44	-	0.55	V

Octal buffer/line driver; inverting; 3-state

Table 6. Static characteristics ...continued

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		25 °C		−40 °C	to +85 °C	–40 °C to +125 °C		Unit
			Min	Тур	Max	Min	Max	Min	Max	
lı	input leakage current	V _I = 5.5 V or GND; V _{CC} = 0 V to 5.5 V	-	-	0.1	-	1.0	-	2.0	μA
l _{oz}	OFF-state output current		-	-	±0.25	-	±2.5	-	±10.0	μA
I _{CC}	supply current	$V_I = V_{CC}$ or GND; $I_O = 0$ A; $V_{CC} = 5.5$ V	-	-	4.0	-	40	-	80	μA
Cı	input capacitance	$V_{I} = V_{CC}$ or GND	-	3	10	-	10	-	10	pF
Co	output capacitance		-	4	-	-	-	-	-	pF
74AHCT	240									
V _{IH}	HIGH-level input voltage	V_{CC} = 4.5 V to 5.5 V	2.0	-	-	2.0	-	2.0	-	V
V _{IL}	LOW-level input voltage	V_{CC} = 4.5 V to 5.5 V	-	-	0.8	-	0.8	-	0.8	V
V _{OH}	HIGH-level	V_{I} = V_{IH} or $V_{IL};V_{CC}$ = 4.5 V								
	output voltage	I _O = -50 μA	4.4	4.5	-	4.4	-	4.4	-	V
		I _O = -8.0 mA	3.94	-	-	3.80	-	3.70	-	V
V _{OL}	LOW-level	$V_{I} = V_{IH} \text{ or } V_{IL}; V_{CC} = 4.5 \text{ V}$								
	output voltage	I _O = 50 μA	-	0	0.1	-	0.1	-	0.1	V
		I _O = 8.0 mA	-	-	0.36	-	0.44	-	0.55	V
lı	input leakage current	$V_I = 5.5 V \text{ or GND};$ $V_{CC} = 0 V \text{ to } 5.5 V$	-	-	0.1	-	1.0	-	2.0	μA
I _{OZ}	OFF-state output current		-	-	±0.25	-	±2.5	-	±10.0	μΑ
I _{CC}	supply current		-	-	4.0	-	40	-	80	μΑ
∆I _{CC}	additional supply current	per input pin; $V_I = V_{CC} - 2.1 V$; other pins at V_{CC} or GND; $I_O = 0 A$; $V_{CC} = 4.5 V$ to 5.5 V	-	-	1.35	-	1.5	-	1.5	mA
CI	input capacitance	$V_I = V_{CC}$ or GND	-	3	10	-	10	-	10	pF
Co	output capacitance		-	4	-	-	-	-	-	pF

Octal buffer/line driver; inverting; 3-state

10. Dynamic characteristics

Table 7. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V); for test circuit see Figure 7.

Symbol	Parameter	Conditions			25 °C		-4	0 °C to +′	125 °C	Unit
				Min	Typ <mark>[1]</mark>	Max	Min	Max (85 °C)	Max (125 °C)	
74AHC2	40							1		
t _{pd}	propagation delay	nAn to nYn; see <u>Figure 5</u>	[2]							
		$V_{CC} = 3.0 \text{ V}$ to 3.6 V; $C_{L} = 15 \text{ pF}$		-	3.9	7.5	1.0	8.6	10.8	ns
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}; C_{L} = 50 \text{ pF}$		-	5.8	11.0	1.0	12.5	15.6	ns
		V_{CC} = 4.5 V to 5.5 V; C_{L} = 15 pF		-	2.8	4.8	1.0	5.7	7.1	ns
		V_{CC} = 4.5 V to 5.5 V; C_{L} = 50 pF		-	4.2	7.3	1.0	8.5	10.6	ns
t _{en}	enable time	nOE to nYn; see <u>Figure 6</u>	[2]							
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}; C_{L} = 15 \text{ pF}$		-	4.4	10.0	1.0	12.0	19.4	ns
		$V_{CC} = 3.0 \text{ V} \text{ to } 3.6 \text{ V}; C_{L} = 50 \text{ pF}$		-	5.8	13.5	1.0	15.5	19.4	ns
		V_{CC} = 4.5 V to 5.5 V; C_{L} = 15 pF		-	3.1	6.5	1.0	7.7	12.5	ns
		V_{CC} = 4.5 V to 5.5 V; C_{L} = 50 pF		-	4.1	8.5	1.0	10.0	12.5	ns
t _{dis}	disable time	nOE to nYn; see <u>Figure 6</u>	[2]							
		$V_{CC} = 3.0 \text{ V to } 3.6 \text{ V}; C_{L} = 15 \text{ pF}$		-	5.3	9.0	1.0	10.0	18.1	ns
		$V_{CC} = 3.0 \text{ V}$ to 3.6 V; $C_{L} = 50 \text{ pF}$		-	8.9	13.0	1.0	14.5	18.1	ns
		V_{CC} = 4.5 V to 5.5 V; C_{L} = 15 pF		-	3.9	5.8	1.0	6.5	8.1	ns
		V_{CC} = 4.5 V to 5.5 V; C_{L} = 50 pF		-	6.2	8.7	1.0	9.5	11.8	ns
C _{PD}	power dissipation capacitance	$V_I = GND$ to V_{CC} ; $C_L = 50 \text{ pF}$; $f_i = 1 \text{ MHz}$	<u>[3]</u>	-	9	-	-	-	-	pF

Octal buffer/line driver; inverting; 3-state

Symbol	Parameter	Conditions		25 °C			–40 °C to +125 °C			Unit
				Min	Typ <mark>[1]</mark>	Max	Min	Max (85 °C)	Max (125 °C)	
74AHCT	240									
t _{pd}	propagation delay	nAn to nYn; see <u>Figure 5</u>	[2]							
		V_{CC} = 4.5 V to 5.5 V; C_L = 15 pF		-	3.0	5.8	1.0	6.8	8.5	ns
		V_{CC} = 4.5 V to 5.5 V; C_{L} = 50 pF		-	4.4	8.4	1.0	9.5	11.9	ns
t _{en}	enable time	nOE to nYn; see Figure 6	[2]							
		V_{CC} = 4.5 V to 5.5 V; C_L = 15 pF		-	3.4	7.5	1.0	9.0	14.4	ns
		V_{CC} = 4.5 V to 5.5 V; C_{L} = 50 pF		-	4.5	9.5	1.0	11.5	14.4	ns
t _{dis}	disable time	nOE to nYn; see <u>Figure 6</u>	[2]							
		V_{CC} = 4.5 V to 5.5 V; C_L = 15 pF		-	3.9	6.1	1.0	6.7	8.3	ns
		V_{CC} = 4.5 V to 5.5 V; C_L = 50 pF		-	6.2	8.7	1.0	9.2	11.5	ns
C _{PD}	power dissipation capacitance	$V_I = GND$ to V_{CC} ; $C_L = 50 \text{ pF}$; $f_i = 1 \text{ MHz}$	<u>[3]</u>	-	9	-	-	-	-	pF

Table 7. Dynamic characteristics ...continued

Voltages are referenced to GND (ground = 0 V); for test circuit see <u>Figure 7</u>.

[1] Typical values are measured at nominal supply voltage ($V_{CC} = 3.3$ V and $V_{CC} = 5.0$ V).

 $\label{eq:pd} [2] \quad t_{pd} \text{ is the same as } t_{PLH} \text{ and } t_{PHL}; t_{en} \text{ is the same as } t_{PZH} \text{ and } t_{PZL}; t_{dis} \text{ is the same as } t_{PLZ} \text{ and } t_{PHZ}.$

[3] C_{PD} is used to determine the dynamic power dissipation (P_D in μ W).

 $P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum (C_L \times V_{CC}^2 \times f_o)$ where:

 f_i = input frequency in MHz;

 $f_o =$ output frequency in MHz;

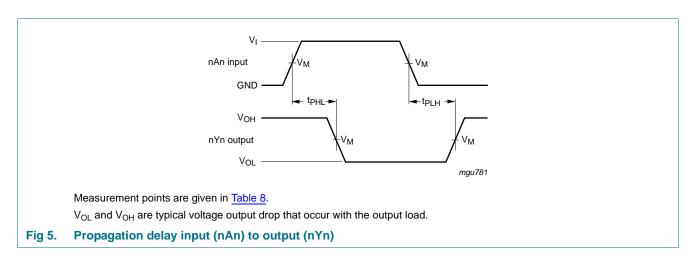
 C_L = output load capacitance in pF;

 V_{CC} = supply voltage in V;

N = number of inputs switching;

 $\Sigma(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

11. Waveforms



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74AHC240; 74AHCT240

Octal buffer/line driver; inverting; 3-state

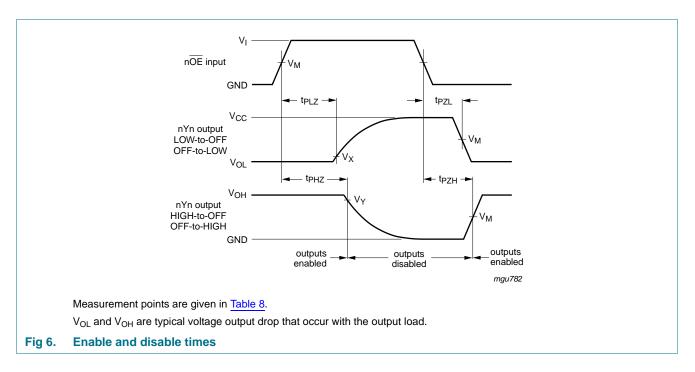


Table 8. Measurement points

Туре	Input	Output					
	V _M	V _M	V _X	V _Y			
74AHC240	0.5V _{CC}	0.5V _{CC}	V _{OL} + 0.3 V	$V_{OH} - 0.3 V$			
74AHCT240	1.5 V	0.5V _{CC}	V _{OL} + 0.3 V	$V_{OH} - 0.3 \ V$			

NXP Semiconductors

74AHC240; 74AHCT240

Octal buffer/line driver; inverting; 3-state

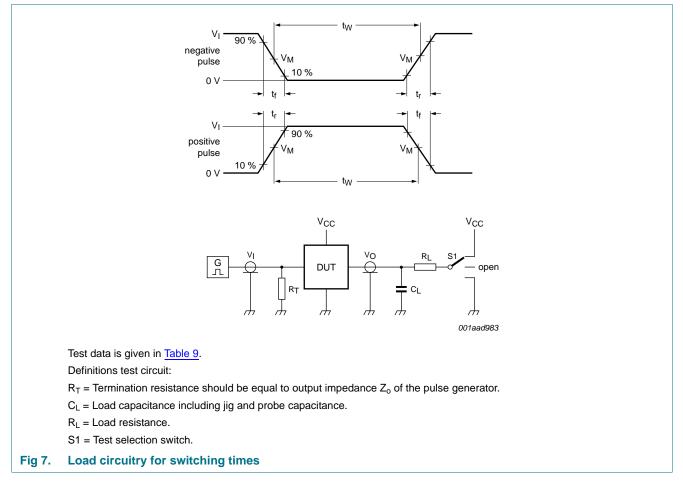


Table 9. Test data

Туре	Input		Load		S1 position			
	VI	t _r , t _f	CL	RL	t _{PHL} , t _{PLH}	t _{PZH} , t _{PHZ}	t _{PZL} , t _{PLZ}	
74AHC240	V _{CC}	3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}	
74AHCT240	3.0 V	3.0 ns	15 pF, 50 pF	1 kΩ	open	GND	V _{CC}	



Octal buffer/line driver; inverting; 3-state

12. Package outline

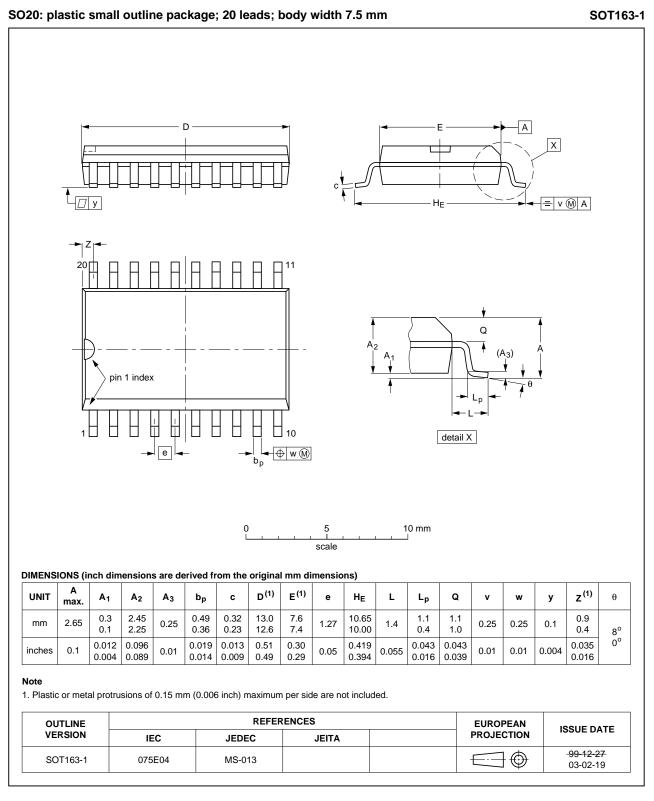


Fig 8. Package outline SOT163-1 (SO20)

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74AHC_AHCT240

Octal buffer/line driver; inverting; 3-state

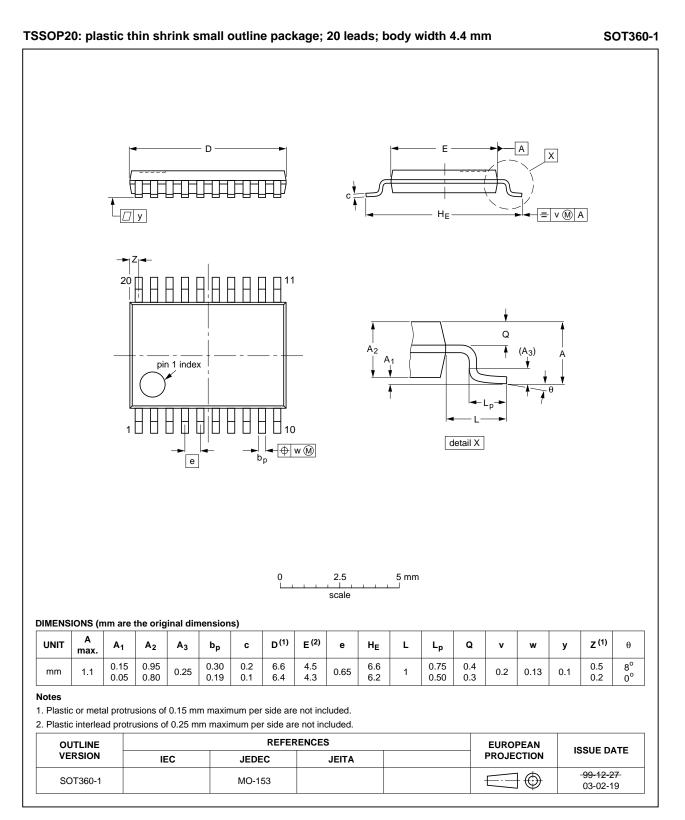
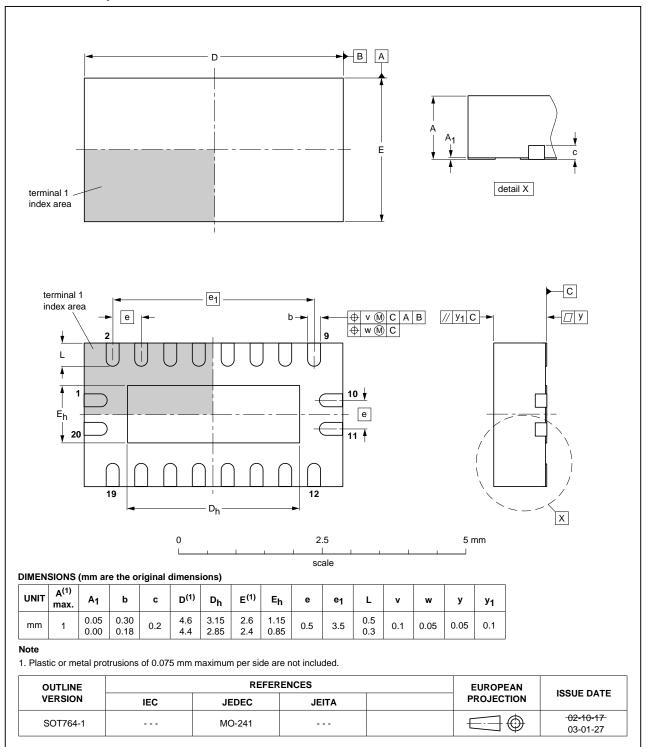


Fig 9. Package outline SOT360-1 (TSSOP20)

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74AHC_AHCT240

Octal buffer/line driver; inverting; 3-state



DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 x 4.5 x 0.85 mm SOT764-1

Fig 10. Package outline SOT764-1 (DHVQFN20)

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74AHC_AHCT240



Octal buffer/line driver; inverting; 3-state

13. Abbreviations

Table 10. Abbreviations				
Acronym	Description			
CDM	Charge Device Model			
CMOS	Complementary Metal Oxide Semiconductor			
DUT	Device Under Test			
ESD	ElectroStatic Discharge			
HBM	Human Body Model			
TTL	Transistor-Transistor Logic			
-				

14. Revision history

Table 11. Revision history							
Document ID	Release date	Data sheet status	Change notice	Supersedes			
74AHC_AHCT240 v.2	20101126	Product data sheet	-	74AHC_AHCT240 v.1			
Modifications:	 Figure note [1] or 	f Figure 4: changed.					
74AHC_AHCT240 v.1	20100111	Product data sheet	-	-			

Octal buffer/line driver; inverting; 3-state

15. Legal information

15.1 Data sheet status

Document status[1][2]	Product status ^[3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

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Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

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17. Contents

1	General description 1
2	Features and benefits 1
3	Ordering information 1
4	Functional diagram 2
5	Pinning information
5.1	Pinning 2
5.2	Pin description 3
6	Functional description 3
7	Limiting values 3
8	Recommended operating conditions 4
9	Static characteristics 4
10	Dynamic characteristics 6
11	Waveforms 7
12	Package outline 10
13	Abbreviations 13
14	Revision history 13
15	Legal information 14
15.1	Data sheet status 14
15.2	Definitions 14
15.3	Disclaimers 14
15.4	Trademarks 15
16	Contact information 15
17	Contents 16

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